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(54) Device applicable to the recycle circuit of various baths for liquid aeration.

(57) The liquid (L) of a bath utilized for various uses is contained within a tank (V) and is moved by a recycle circuit constituted by a pump (P) disposed below said tank (V), which sucks the liquid (L) therefrom through a suction conduit (CA) and returns it into the same tank through a delivery conduit (CR).

The suction conduit (CA) has a vertical portion (CAV) at the upper end of which a filter (F) is disposed, which generates a localized loss of pressure (PC) at least fairly greater than the hydrostatic pressure (PI1) existing at this position and able to develop a depression (D1) which is progressively decreasing at the underlying vertical portion (CAV) thereof, for having a correspondent progressive increasing of the hydrostatic pressure (PI1) thereof. An end (E1) of an aeration conduit (CM) terminates at the zone under depression provided in said vertical portion (CAV) and such end (E1) can be also shifted at different positions therealong, while on the contrary the other end (E2) thereof is disposed above the bath surface level (PL). Consequently, an air suction is obtained through said aeration conduit (CM), which air is being mixed to the liquid being circulating through the recycle circuit and such suction may be adjusted by changing the position of the end (E1) of the aeration conduit which is terminating into said vertical portion (CAV).

It is also possible to change the rate of flow of

said aeration conduit (CM), by a suitable regulating means fitted thereto, such as a cock or the like.

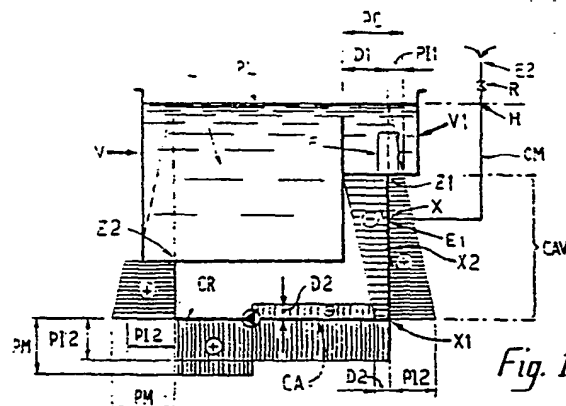


Fig. 1

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## DEVICE APPLICABLE TO THE RECYCLE CIRCUIT OF VARIOUS BATHS FOR LIQUID AERATION

The present invention relates to a new device, applicable to the recycle circuit of various baths, in particular the baths employed for the chemical treatments of photographic processes, for obtaining aeration and the subsequent oxygenation of the liquid.

It is known that various baths for different uses require a constant liquid oxygenation, which is usually obtained mostly by injection of atmospheric air therein, which is adequately pumped while bubbling it into the liquid of the same bath.

Often, the baths requiring such oxygenation are also steadily mixed up by means of a suitable recycle device which, as already known, provides an adequate pump which draws the liquid from a bath zone, through a conduit, and returns it to another zone of the same bath, through another conduit, so as to determine an uniform movement throughout the liquid.

On the contrary, the oxygenation thereof is obtained by another small pump which blows in air into the liquid of the same bath.

This double action of aeration and recycle of the bath, obtained with two separate devices, is usually employed in particular in the machines for developing photographic films, the so-called "film developing machines".

Normally, particularly in the above mentioned machines, also a filter is disposed in the recycle circuit thereof, which filter is able to retain eventual impurities produced during the different employed chemical processes, so as the liquids of the different baths are pure as much as possible, in order to avoid undesirable deposits onto the photosensitive material under treatment.

According to the present invention, the liquid aeration is obtained in a very simple manner by utilizing the sole recycle circuit, which fact permits to obtain, obviously, besides to a remarkable reduction of component parts and therefore a considerable constructive simplicity, a considerable reduction of the manufacturing and maintenance costs.

Moreover, clearly, it is known that the reduction of the component parts increases the whole reliability of the machine.

Therefore, the device referred to is applicable to the recycle circuit of the liquid of different baths and is particularly utilisable for obtaining the aeration of the chemical treatment baths of film developing machines and the like, in which the liquid of the baths is moved by means of a recycle circuit constituted in a per se known manner by a recycle pump which sucks the liquid, through a suction conduit, from the relative bath contained into a tank

by drawing it from an intake zone thereof and moves this liquid through a delivery conduit towards an additional delivery zone of the same tank, said device being characterized in that said recycle pump is disposed below said tank and said suction conduit has a vertical portion, at the upper end of which a filter is disposed, which filter is able to generate a localized loss of pressure, which is greater than at least the hydrostatic pressure of the overlying liquid or preferably is also fairly greater than the hydrostatic pressure existing at the level of the recycle pump, said localized loss of pressure being of such value as to develop a depression downstream said filter, which depression is progressively decreasing along said vertical portion due to the progressive increasing of the hydrostatic pressure, wherein an end of an aeration pipe which is positionable at different positions along said vertical portion of the suction conduit is terminating into the part under depression of such vertical portion, wherein the other end of said aeration pipe, on the contrary, is disposed above the bath surface level and terminates in correspondence of the ambient air, thus obtaining an adjustable suction of the air being mixed to the liquid, and finally additional means for regulation of the rate of flow of said aeration pipe could be provided.

In order to understand better the features and advantages attainable by the device referred to, this latter is hereinafter described more in detail, by way of a not limitative example only and with reference to the attached drawing, in which:

- fig. 1 schematically shows the device according to the present invention, and

- fig. 2 shows a partially cut view of a generic tank for a chemical treatment bath of a film developing machine, to which such device is connected.

In such figures, the same items are provided with the same references.

Moreover, it is noted that in fig. 1 the diagrams of the relative pressures through the recycle circuit are shown in an arbitrary scale, by assuming the conduits of such recycle circuit as reference axis correspondent to the atmospheric pressure and by arranging outside it the positive pressure values thereof and inside it the negative pressure values (depressions) thereof.

Therefore, with particular reference to fig. 1, it is to be noted the tank V and the chamber V1 which is extended laterally and on the upper side thereof and is intercommunicating therewith, where the liquid L to be recycled and aerated is contained into said tank V and said chamber V1, and a

recycle circuit for the liquid L constituted by a recycle pump P disposed below the tank V and the chamber V1 and whose intake side is connected, through the suction conduit CA, to the intake zone Z1 thereof provided on the bottom of said chamber V1 and which also is connected with its delivery side, through the delivery conduit CR, to a delivery zone Z2 provided on the bottom of the tank V.

The suction conduit CA comprises a vertical portion CAV whose upper end terminates into said intake zone Z1, where the outlet of a filter F disposed just upstream such upper end is connected.

Besides, at a position X which can be differently positioned along said vertical portion CAV, terminates the lower end E1 of an aeration pipe CM, whose other (upper) end is disposed on the contrary above the bath surface level PL and terminates at the ambient air.

In addition, said aeration pipe CM can be provided with a suitable means R for regulating its rate of flow, for the reasons set forth below.

Always considering the fig. 1, it is noted that for a better clearness and simplicity in the diagrams showing the pressure trend along the recycle circuit the linear loss of pressure isn't taken into account, which loss of pressure is determined along the conduits of such circuit and is negligible and anyhow uninfluential for the purposes which will be hereinafter described.

The device operates in the following manner.

When the recycle circuit does not operate, that is when the recycle pump P is still, at the level thereof it is present a hydrostatic pressure PI2 which is progressively increasing from the bath surface level PL.

Consequently, at the level of the intake zone Z1 it is present a hydrostatic pressure PI1 which is progressively increasing in the following vertical portion CAV. In this condition, the liquid L will penetrate into the aeration pipe CM and attain the point H of static balance, which corresponds to the bath surface level PL, however without leaving clearly the upper end E2 thereof, which end is disposed, as already described, at a higher level.

On the contrary, when the recycle circuit is operating, the recycle pump P sucks the liquid L from the intake zone Z1, through the suction conduit CA, and delivers it through the delivery conduit CR, with a delivery pressure PM which is adequately greater than the hydrostatic pressure PI2, to the delivery zone Z2.

In this condition, at the filter F the liquid suffers from a localized loss of pressure PC, which is greater than the value of the hydrostatic pressure PI1, so that at the correspondent intake zone Z1 it is determined a depression D1, from the difference between the hydrostatic pressure PI1 in such zone Z1 and the loss of pressure PC.

Clearly, downstream such intake zone Z1 along the vertical portion CAV the depression level will progressively decrease because of the progressive increasing of the hydrostatic pressure.

If the loss of pressure PC is greater to the hydrostatic pressure PI2 too, which is present at the level of the recycle pump P, a depression D2 is determined at the level thereof, so that also the whole subsequent part of the suction conduit CA is under depression.

On the contrary, if the loss of pressure PC, which anyhow is always greater than the hydrostatic pressure PI1, is identical or lower than the hydrostatic pressure PI2, the depression D1 is annulled respectively at the level of the recycle pump P, at the point X1 resulting to be situated at the lower end of said vertical portion CAV, or at a point X2 resulting to be situated therealong.

In all cases, along said vertical portion CAV there is a more or less long part thereof, calculated from the upper end thereof, i.e. just after the filter F, which part is submitted to a more or less high depression, which anyhow is greater than the hydrostatic pressure of such part, and which is progressively decreasing towards the lower end thereof, so that the aeration pipe CM terminating with its lower end E1 in such part is also under depression and thus sucks air from the ambient with its upper end E2, which air is mixed to the liquid flowing through said aeration conduit CA, so obtaining the desired aeration effect. Clearly, by shifting the position of the lower end E1 of said aeration conduit CM along said part under depression, it is obtained a change in the amount of sucked air (rate of flow) and therefore in the relevant mixing ratio thereof to the bath liquid.

An additional possibility of change in the amount of sucked air, moreover, is obtained by maintaining unchanged the position of the lower end E1 of said aeration conduit CM and arranging a suitable adjusting means of the rate of flow R, i.e. an adequate cock or the like thereon. From what described it appears evident the operation of the device according to the present invention as well as the advantages obtained by utilization thereof.

In fact, it appears evident that the use of this device allows a considerable simplification of the liquid aeration system, so avoiding any use of a special circuit usually comprising a pump and other elements added to the recycle circuit.

Thus, fig. 2 illustrates by way of example a possible use of the device referred to in a tank of one of the chemical treatment baths of a film developing machine.

The various elements illustrated by this figure which are fully equivalent to the correspondent elements of fig. 1 are marked with the same references, and some items only which illustrate a

possible practical embodiment of the system for mounting the filter F and the aeration conduit CM and adjusting the position of the lever end E1 thereof into the aeration conduit CA, are marked with own references. Therefore, with reference to fig. 2 it is still used a tank V, which in this case is the tank in which a suitable device permitting a film sliding into the relative bath thereof is introduced therein, which tank is communicating with a chamber V1 shaped in a conventional and per se known manner and provided normally for containing the thermostatic, filtering and aerating devices for the bath liquid L.

The bath liquid L too is moved in a conventional and per se known manner by a relative recycle circuit thereof, also formed by a recycle pump P which is arranged below the tank V and sucks the liquid from the bottom of the chamber V1, through the suction conduit CA and returns it into the same tank V through the delivery conduit CR.

As the schematic example shown in fig. 1, the suction conduit CA comprises a vertical portion CAV, which is extended from the intake zone Z1 provided at the bottom side of the chamber V1 to the level of the recycle pump P.

In the practical embodiment of fig. 2 the suction conduit CA and the delivery conduit CR are respectively formed by the hose portions 11 and 12, which connect the suction and delivery side of said pump P to the connections A1 and A2 constituted by the correspondent cylindrical sleeves 21 and 31.

The cylindrical sleeve 21 terminates at its upper part, inside the chamber V1, with a first cup-shaped element 22 in which the lower end of the filter F is introduced therein, which filter is made of a tubular cylindrical element 23 of an adequate filtering material, whose upper end is disposed below the bath surface level PL and onto which a second cup-shaped element 24 identical to the previous one (22) is fitted, which latter element is arranged symmetrically opposed to the other one.

A tubular cylindrical body 25 having an inner threaded inner coaxial hole 251 is projected upwardly from the upper part of said second cup-shaped element 24, at a central position thereof.

Such tubular cylindrical body 25 terminates with its upper end E2 at a level higher than the bath surface level PL and the correspondent upper end of the relative threaded hole 251 thereof engages tightly a threaded cylindrical element 26, provided at its upper end with a regulating nut 261 and into which a pipe 3 constituting the aeration conduit CM is connected coaxially thereto.

The pipe 3 terminates with its lower end E1 downstream the filter and inside the conduit forming said vertical portion CAV and terminates with

its upper end E2, above said regulating nut 261, at the ambient air.

Clearly, by screwing or unscrewing said threaded cylindrical element 26 through its regulating nut 26, it is possible to change the position of the lower end E1 of said aeration conduit CM, at the vertical portion CAV of the suction conduit CA of the recycle circuit and therefore the position of the correspondent mixing point X thereof.

Such regulation, for the reasons previously explained, permits to vary the air suction through said aeration conduit CM and consequently to adjust in a very careful way its mixing ratio to the liquid of the bath under recycle condition. As already stated, it is also possible to obtain a change in the air rate of flow in the aeration conduit CM, by maintaining unchanged the lower end E1 of such conduit CM and by arranging a suitable regulating means as an adequate cock R or the like thereon.

What it has been described refers to a particular use, that is of the chemical treatment baths of film developing machines; obviously, the same device and the same principle according to the present invention may be also used for other various uses and clearly, the unit constituted by the tank V and the chamber V1, which is usually provided in such specific use, may be constituted by a sole tank V in other uses thereof.

Finally, it is pointed out that in cases in which it isn't required a filter F, the localized loss of pressure may be determined by an adequate throttling provided at the same position thereof.

These and other variants may be brought to the invention referred to, however without departing from what described and hereinafter claimed with reference to the attached drawing and therefore from the protection field of the present industrial invention.

#### Claims

1) Device applicable to the recycle circuit of various baths for the aeration of the liquid, particularly utilizable for obtaining the aeration of the chemical treatment baths of film developing machines and the like, in which the liquid (L) of the baths is moved by means of a recycle circuit constituted in a per se known manner by a recycle pump (P) which sucks the liquid, through a suction conduit (CA), from the relative bath contained into a tank (V) by drawing it from an intake zone (Z1) thereof and moves it through a delivery conduit (CR) towards an additional delivery zone (Z2) of the same tank (V), said device being characterized in that said recycle pump (P) is disposed below said tank (V) and said suction conduit (CA) has a vertical portion (CAV) at the upper end of which a

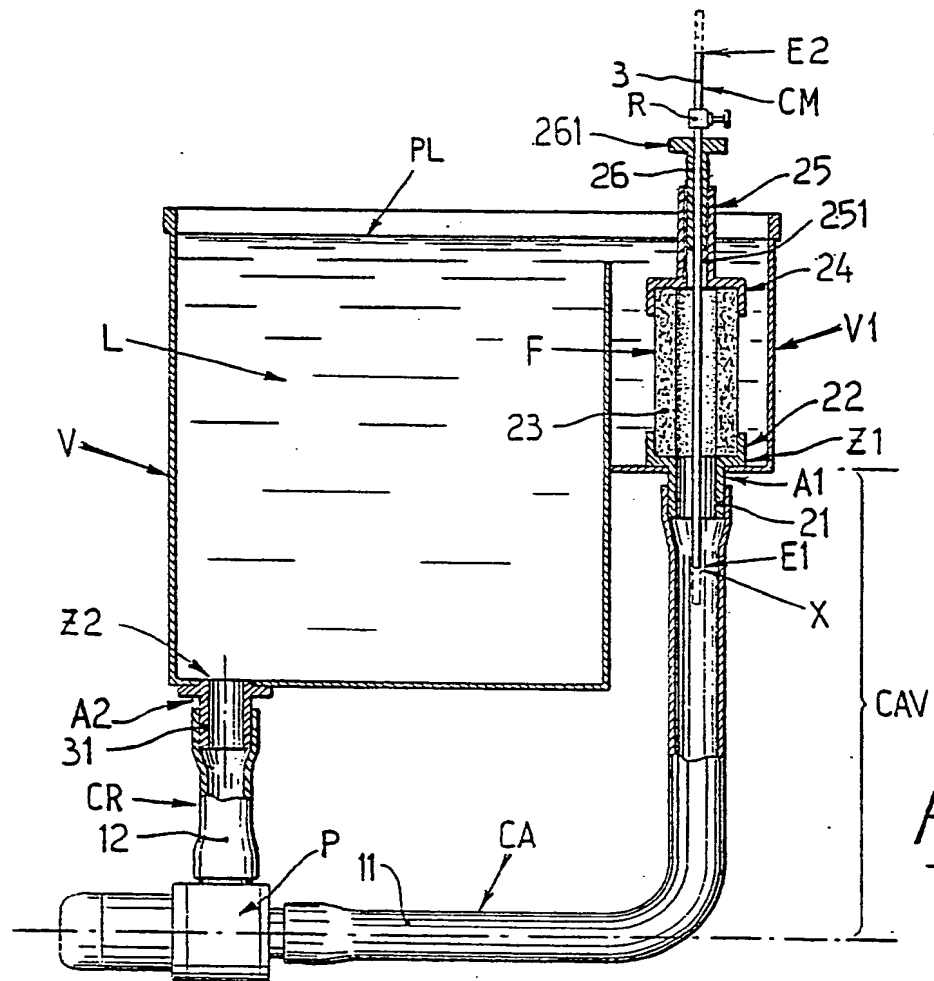
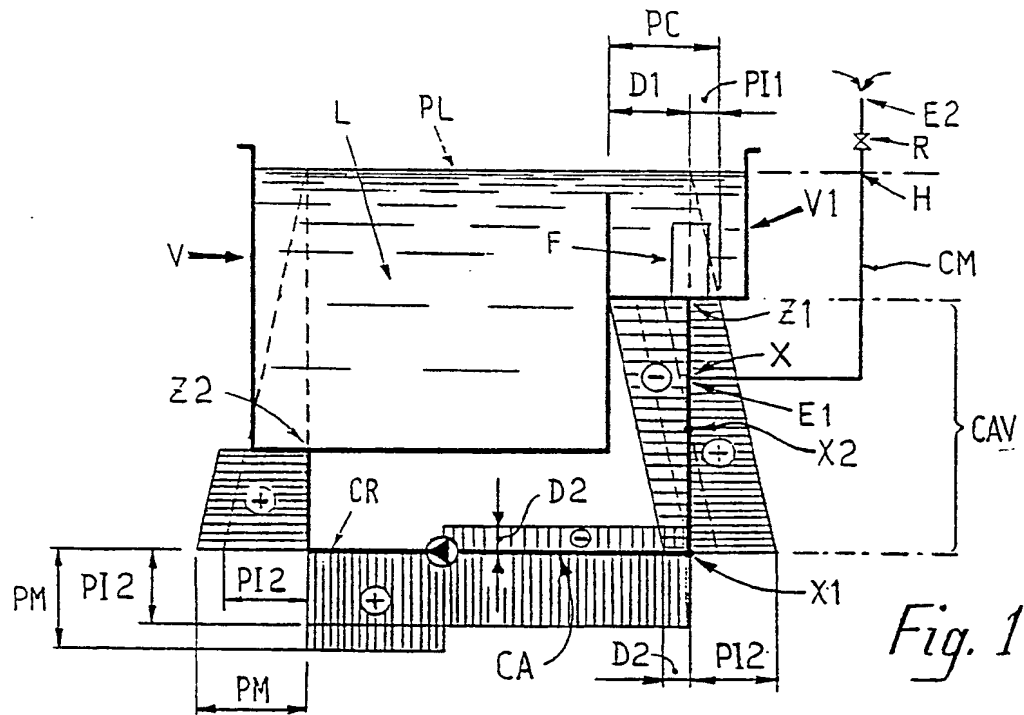
filter (F) is disposed, which is able to generate a localized loss of pressure (PC) greater than at least the hydrostatic pressure (PI1) of the overlying liquid or also preferably fairly greater than the hydrostatic pressure (PI2) existing at the level of the recycle pump (P), said localized loss of pressure (PC) being able to develop a depression (D1-D2) downstream said filter (F), which is progressively decreasing along said vertical portion due to the progressive increasing of the hydrostatic pressure (PI1-PI2), wherein an end (E1) of an aeration pipe (CM) which is positionable at different positions along the same vertical portion of the suction conduit is terminating into the part under depression of said vertical portion, wherein the other end (E2) of which is disposed, on the contrary, above the bath surface level (PL) and terminates in correspondence of the ambient air, thus obtaining an adjustable suction of the air being mixed to the liquid, and finally additional means (R) for regulation of the rate of flow of said aeration pipe could be provided.

2) Device according to claim 1, characterized in that said filter (F) is constituted preferably by a tubular element (23) made of a suitable filtering material, said tubular element (23) being removably inserted tightly, at its lower end, into a first cup-shaped element (22), wherein on the contrary a second cup-shaped element (24) is also removably fitted tightly onto the upper end thereof, which element is disposed in opposition to the previous one and is provided centrally with an inner threaded tubular body (25) which, when is fitted thereon, has its upper end projected from bath surface level, wherein a threaded cylindrical element (26) is removably engaged in an adjustable manner with the inner threaded part (251) of said tubular body (25), and wherein a pipe (3) forming said aeration conduit (CM) is coaxially tightly fitted into the threaded cylindrical element (26), which pipe (3) coaxially passes through the central hole of said tubular element (23) constituting the filter (F) and also terminates with its lower end (E1) downstream the filter into said vertical portion (CAV) of said suction conduit (CA), while its upper end (E2) terminates at the ambient air, above the bath surface level.

3) Device according to claim 1, characterized in that in case in which the recycle circuit doesn't require a filter (F), this may be replaced by a suitable braking element fitted in the same zone of the recycle circuit and able to determine an equivalent localized loss of pressure.

4) Device according to claims 1 and 3, characterized in that said braking element may be advantageously constituted by a centrally perforated flange, whose central hole has an adequately reduced diameter for generating a localized loss of pressure.

5) Device according to claims 1 and 3, characterized in that said braking element may be advantageously constituted by a regulating device like a cock or the like, which is able to cause a localized loss of pressure which in this case is also variable.





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# EUROPEAN SEARCH REPORT

Application Number

EP 89 10 5836

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. 4)
X	FR-A-2 120 292 (PAKO CORP.) * Page 1, lines 1-22; page 1, line 31 - page 3, line 39; figures 1-3; claims 1,3,4,7,8 *	1,3-5	B 01 F 5/10 G 03 D 3/02
A	CH-A- 642 563 (UTB UMWELTECHNIK BUCHS AG) * Whole document *	1-5	
A	DE-A-3 309 834 (A. HUMPEL) * Page 8, line 13 - page 11, line 36; figures 1,2 *	1-4	
A	PATENT ABSTRACTS OF JAPAN, vol. 10, no. 52 (P-432)[2109], 28th February 1986, page 8 P 432; & JP-A-60 194 455 (FUJI SHASHIN FILM K.K.) 02-10-1985	1	
A	EP-A-0 151 442 (GRETAG SAN MARCO S.p.A.)		
			TECHNICAL FIELDS SEARCHED (Int. Cl.4)
			B 01 F G 03 D
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 19-06-1985	Examiner CUNY J.M.J.C.
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